Space Weather Technical Forecast

Issued on Saturday, 26 August 2023 at 01:13 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of isolated M-flares throughout (R1-R2 Blackouts).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Moderate with a peak flare of M1.4 at 25/0109 UTC from AR3415 in the southeast. There are six sunspot region on the disc. AR3415 (Dac/Beta-Delta) remains the most complex and active region with two moderately strong umbra spots sharing the same small penumbra. This region continues to provide a risk of significant flares, especially if any additional development occurs. AR3413 (Dko/Beta) is the largest region and is approaching the north-centre disc. This has developed a more asymmetric dominant positive leader spot due to the inclusion of a small spot to its north. Despite some potential instability, with an east-west parity separation line, this region remains inactive. The other regions are all small and simple unipolar spots, although AR3405 (Hsx/alpha) now approaching the west limb, has shown some low level activity in recent days.

No Earth-directed CMEs have been observed, with the previous candidates assessed as missing.

Solar Wind / Geomagnetic Activity: Brief fast wind conditions from CH39/+ HSS eased, with a return to background slow wind. Speeds, observed by ACE at L1, eased from slightly elevated at around 470 km/s to be at background 350-400kms by 25/1200 UTC. Density remained around average. The interplanetary magnetic field (IMF) Bt, was weak throughout at below 6nT. The north-south component has been mainly negative (southward) with only brief periods of positive (northward) direction, varying between +/- 4nT. Phi angle was mainly positive (away from the Sun) but with brief forays into negative (towards the Sun). Geomagnetic activity was Quiet to Unsettled (Kp 0-2).

Energetic Particles / Solar Radiation: GOES16 high energy (greater than 10MeV) proton flux remained at Background. GOES16 high energy (greater than 2MeV) electron flux was mostly at Background, rising briefly to peak Moderate with 191 pfu at 25/1935 UTC. The associated 24-hour fluence was well below Active, with 3.41e6 integrated pfu observed at 26/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar Activity is expected to be generally Low, but with a chance of isolated M-class flares.

Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs. The next forecast solar wind enhancement will be the arrival of the fast wind of equatorial CH38/- or northern disc CH37/-, either late day 1 or day 2 (26-27 Aug). These winds then easing day 3 (28 Aug) onward, Geomagnetic activity is forecast to be mainly Quiet at first, but rising to Unsettled with a chance of Active intervals from the fast wind enhancement later day 1 or day 2 (26-27 Aug). Activity then easing to be Quiet with Unsettled intervals.

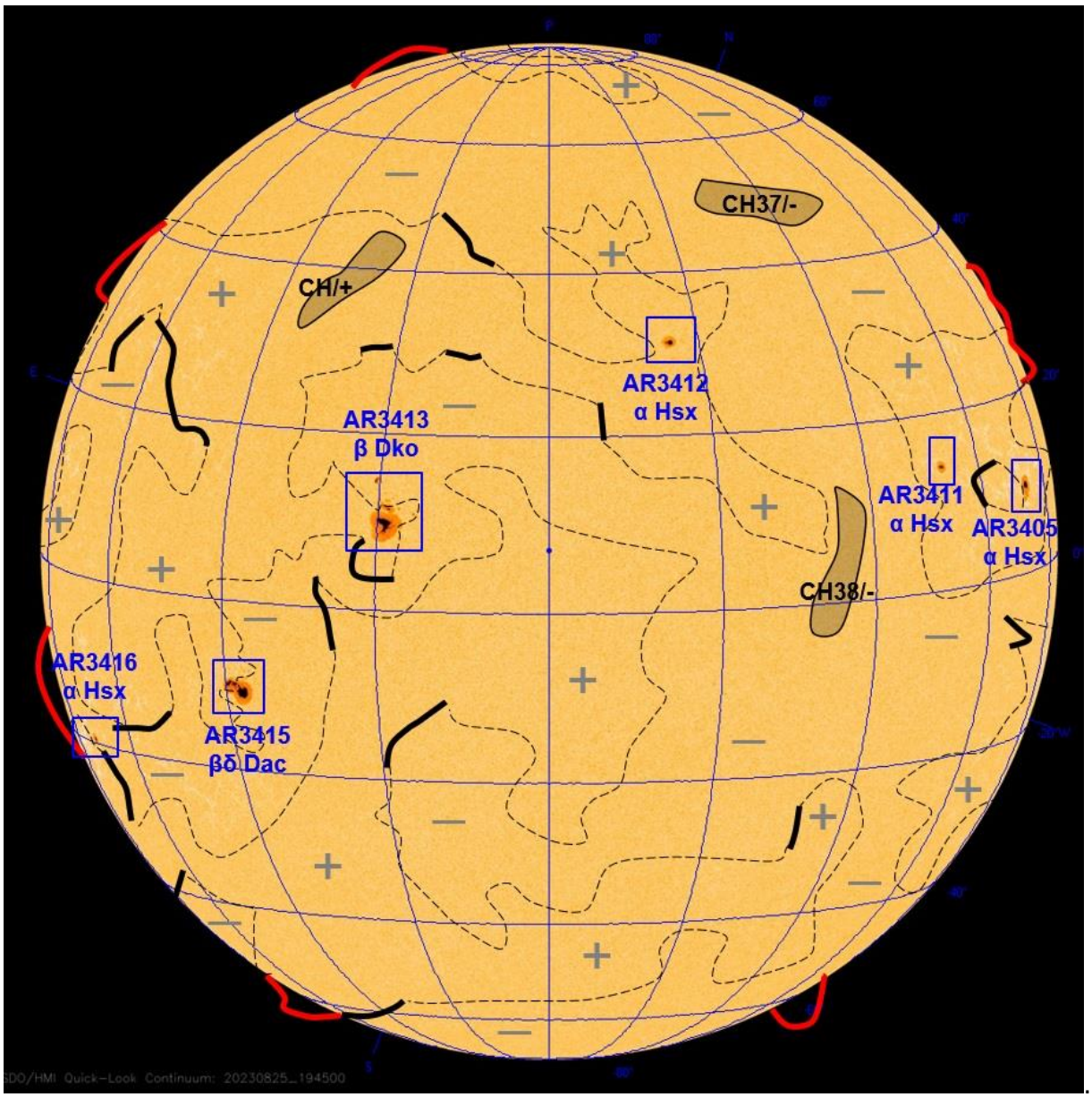
Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux is expected to remain at Background. High energy (greater than 2 MeV) electron flux has not responded to the recent fast wind, and is now expected to persist at mainly Background until any

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2023. All Rights Reserved.

subsequent enhancement from CH37/38 eased either later day 2 or day 3 (27-28 Aug). Flux is then likely to rise, perhaps to Moderate, with a slight chance of rising to High (1000 pfu) by the end of the period. The associated 24 hour fluence is expected to remain below the Active level (1e8 integrated pfu).

Figure 1. Solar Analysis Valid 25/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2023. All Rights Reserved.

Geomagnetic Storms:

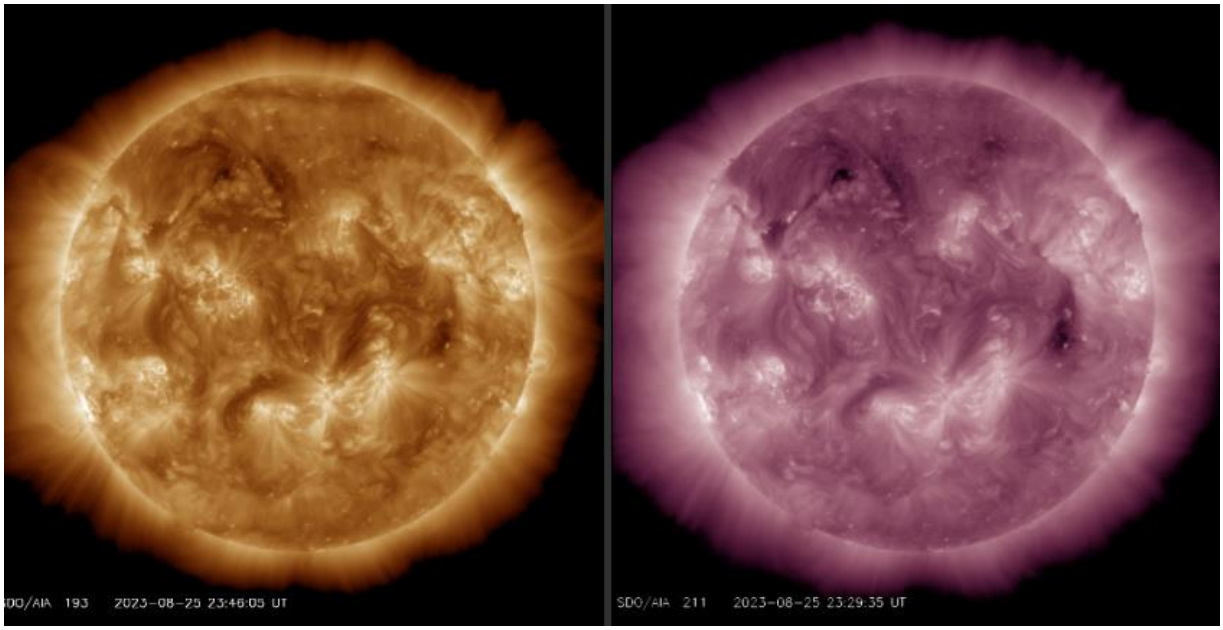
There are no Earth directed CMEs.

Slow winds are expected to prevail at first, with background speeds, before the arrival of the next fast wind, likely from equatorial CH38/-, but perhaps CH37/- on the northern disc. Onset is currently forecast for either late day 1, or more likely day 2 (26-27 Aug), based upon the longitudinal position and an expected peak speed of around 450-500km/s. While MOSWOC Enlil continues to have a poor representation of recent conditions, which reduces confidence in the model forecast, this also suggests an enhancement around a similar time (26-27 Aug). Any connection to this hole is likely to be relatively subdued due to its negative polarity and the Russel-Mcpherron effect.

Geomagnetic activity is forecast to be mainly Quiet at first, increasing to Unsettled with a chance of Active intervals with the HSS arrival, perhaps late day 1 but most likely day 2 (26-27 Aug). This easing again to Quiet with Unsettled intervals day 3-4 (28-29 Aug).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	5	10	1	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: SDO aia-193 and aia-211 showing coronal hole locations



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2023. All Rights Reserved.

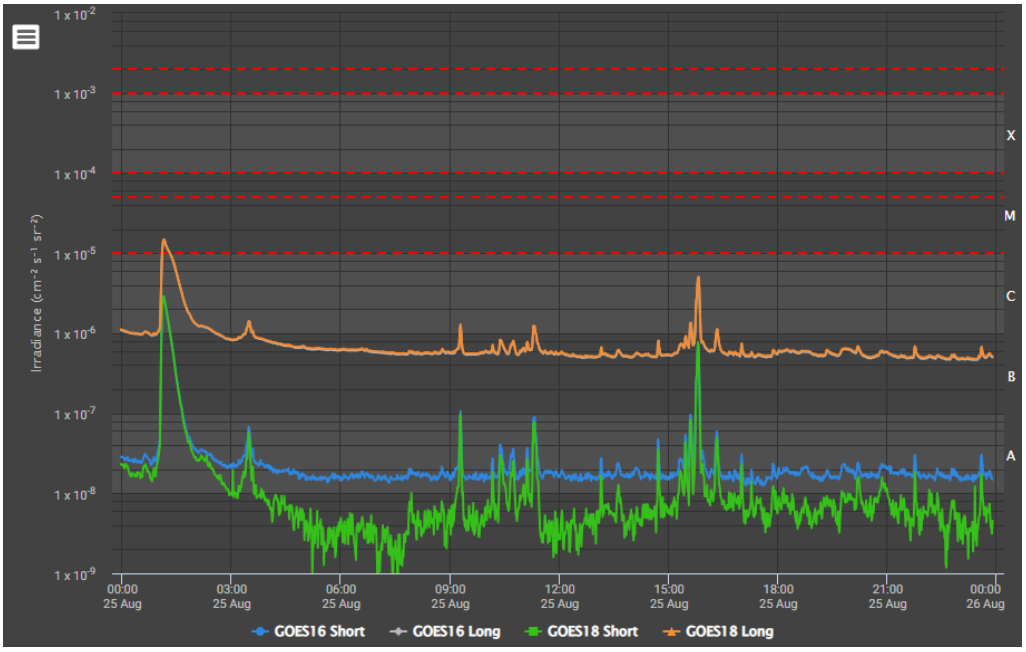
Radio Blackouts - X-Ray Flares:

Low activity is expected to continue, but with a chance of rising to Moderate due to a risk of isolated M-flares throughout. A very isolated X-flare cannot be completely ruled out.

There are six sunspot regions on the disc. The majority are small and mature, however there are three of some interest. AR3415 in the southeast is the most complex, with a reasonably strong delta spot, but aside from the M1.4 flare on 25 Aug, has remained largely inactive. This spot is also showing some mixed development with reducing penumbral extent and breaking of its trailer umbra but also the growth of a few small pore like spots on its periphery. The largest spot on the disc, AR3413, is now approaching the northern-central disc. This has seen its leader become more asymmetric, as it absorbed a small spot that developed to its north. However this region also remains inactive. Out of the mature and unipolar spots AR3405 is the largest and has shown some low level activity, however this appears to be simplifying as it approaches the northwest limb.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	30	30	30	30
Very Active	R3 to R5 X Class	No	5	5	5	5

Figure 3: GOES-16/18 X-ray Flux. M1.4 flare was from AR3415



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

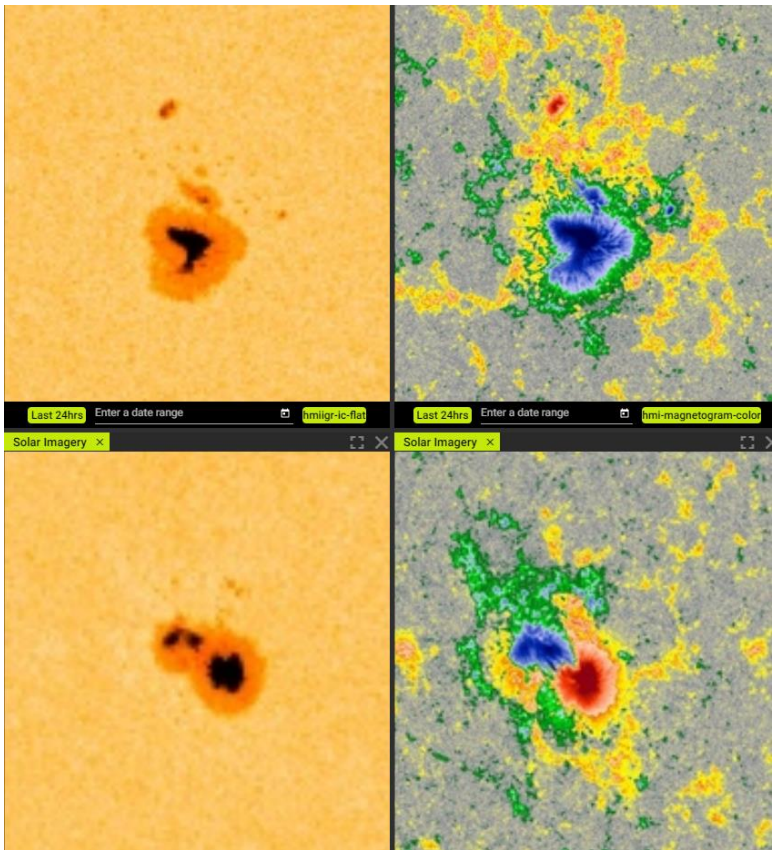
© Crown Copyright 2023. All Rights Reserved.

Solar Radiation Storms - (High Energy Protons):

High energy (greater than 10MeV) proton flux observed by GOES16 is expected to remain at Background. The main risk of any increased proton flux would be from the occurrence of any larger flares of AR3415, currently in the eastern hemisphere.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	2	2	2	2
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Figure 4: SDO Intensitygram (left) and Magnetogram (right) of AR3413 (top) and AR3415 (bottom)



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2023. All Rights Reserved.

High Energy Electrons Event (≥ 2MeV):
High energy (greater than 2 MeV) electron flux observed by GOES16 persisted at mainly background levels, with only a subdued response to the recent high speed stream. A further fast wind arrival either late day 1 or more likely day 2 (26-27 Aug) may bring a further enhancement. However, given the limited geomagnetic response anticipated, any increase to the observed flux is again likely to be rather limited, peaking at Moderate with only a slight chance of reaching High at diurnal maximum
The associated 24 hour fluence is expected to remain below the Active (1e8 integrated pfu) level, but rising later the period in response to this enhancement. Below Active fluence is currently supported by REFM.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	5	10
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 5: GOES-16 >2MEV Electron flux (top) and Fluence with REFM and Recurrence (bottom)

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2023. All Rights Reserved.